IEM's AI Modeling: Short-term COVID-19 Projections

Date: 8/18/21

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 8/18/21 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

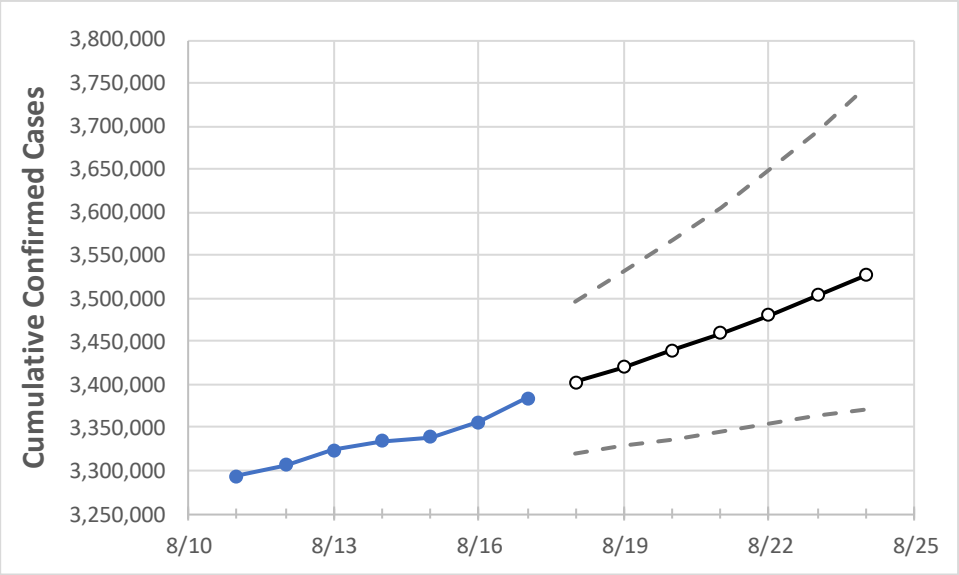
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

Texas State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24
Texas	3,334,027	3,339,500	3,356,260	3,384,466	3,402,253	3,420,489	3,439,435	3,459,798	3,480,869	3,503,722	3,526,787

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

Texas Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24
Bexar	261,170	262,704	264,238	266,027	267,822	269,647	271,549	273,509	275,545	277,612	279,670
Brazoria	44,758	45,009	45,259	46,049	46,507	46,988	47,513	48,070	48,667	49,312	49,965
Brazos	29,689	29,713	29,737	29,802	29,868	29,936	30,007	30,078	30,150	30,222	30,299
Collin	101,641	101,890	102,433	103,234	103,780	104,344	104,925	105,537	106,172	106,852	107,571
Dallas	330,511	330,808	331,106	335,523	337,108	338,750	340,508	342,377	344,426	346,439	348,686
Denton	83,744	83,979	84,214	84,629	85,075	85,552	86,059	86,586	87,147	87,744	88,361
El Paso	139,730	139,794	139,921	140,067	140,203	140,344	140,485	140,634	140,785	140,940	141,098
Ellis	24,992	25,117	25,241	25,366	25,495	25,628	25,763	25,910	26,058	26,212	26,370
Fort Bend	77,764	77,872	77,980	79,102	79,480	79,879	80,302	80,723	81,164	81,630	82,130
Galveston	48,919	49,097	49,274	49,937	50,346	50,763	51,194	51,635	52,087	52,548	53,018
Harris	451,746	454,009	454,416	457,958	460,402	462,976	465,737	468,670	471,817	474,813	478,204
Hidalgo	103,430	103,591	103,752	104,273	104,647	105,019	105,393	105,768	106,150	106,537	106,939
Johnson	21,763	21,830	21,896	21,963	22,050	22,137	22,229	22,325	22,424	22,524	22,624
Lubbock	53,078	53,223	53,368	53,513	53,711	53,913	54,121	54,337	54,560	54,792	55,023
McLennan	30,940	30,940	30,940	30,940	31,144	31,354	31,567	31,789	32,018	32,254	32,501
Montgomery	64,816	65,161	65,505	65,505	65,956	66,420	66,878	67,360	67,838	68,322	68,798
Tarrant	284,614	285,466	287,244	288,627	289,949	291,329	292,802	294,337	295,959	297,631	299,406
Travis	95,372	95,691	96,009	96,668	97,135	97,614	98,106	98,627	99,140	99,657	100,176
Williamson	56,084	56,432	56,780	57,527	57,964	58,414	58,880	59,358	59,835	60,347	60,851

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- *Beds: For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report (MMWR, March 18, 2020) and state reports of COVID-19 cases.*
- *ICU: The CDC report found that 24% of hospitalized cases require ICU care.*
- *Ventilators: Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.*

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

*The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.*

Texas Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:											
	8/14	8/15	8/16	8/17	8/19				8/21				8/23			
Bexar	261,170	262,704	264,238	266,027	269,647	(53,929)	[12,943]	{6,472}	273,509	(54,702)	[13,128]	{6,564}	277,612	(55,522)	[13,325]	{6,663}
Brazoria	44,758	45,009	45,259	46,049	46,988	(9,398)	[2,255]	{1,128}	48,070	(9,614)	[2,307]	{1,154}	49,312	(9,862)	[2,367]	{1,183}
Brazos	29,689	29,713	29,737	29,802	29,936	(5,987)	[1,437]	{718}	30,078	(6,016)	[1,444]	{722}	30,222	(6,044)	[1,451]	{725}
Collin	101,641	101,890	102,433	103,234	104,344	(20,869)	[5,008]	{2,504}	105,537	(21,107)	[5,066]	{2,533}	106,852	(21,370)	[5,129]	{2,564}
Dallas	330,511	330,808	331,106	335,523	338,750	(67,750)	[16,260]	{8,130}	342,377	(68,475)	[16,434]	{8,217}	346,439	(69,288)	[16,629]	{8,315}
Denton	83,744	83,979	84,214	84,629	85,552	(17,110)	[4,106]	{2,053}	86,586	(17,317)	[4,156]	{2,078}	87,744	(17,549)	[4,212]	{2,106}
El Paso	139,730	139,794	139,921	140,067	140,344	(28,069)	[6,737]	{3,368}	140,634	(28,127)	[6,750]	{3,375}	140,940	(28,188)	[6,765]	{3,383}
Ellis	24,992	25,117	25,241	25,366	25,628	(5,126)	[1,230]	{615}	25,910	(5,182)	[1,244]	{622}	26,212	(5,242)	[1,258]	{629}
Fort Bend	77,764	77,872	77,980	79,102	79,879	(15,976)	[3,834]	{1,917}	80,723	(16,145)	[3,875]	{1,937}	81,630	(16,326)	[3,918]	{1,959}
Galveston	48,919	49,097	49,274	49,937	50,763	(10,153)	[2,437]	{1,218}	51,635	(10,327)	[2,479]	{1,239}	52,548	(10,510)	[2,522]	{1,261}
Harris	451,746	454,009	454,416	457,958	462,976	(92,595)	[22,223]	{11,111}	468,670	(93,734)	[22,496]	{11,248}	474,813	(94,963)	[22,791]	{11,396}
Hidalgo	103,430	103,591	103,752	104,273	105,019	(21,004)	[5,041]	{2,520}	105,768	(21,154)	[5,077]	{2,538}	106,537	(21,307)	[5,114]	{2,557}
Johnson	21,763	21,830	21,896	21,963	22,137	(4,427)	[1,063]	{531}	22,325	(4,465)	[1,072]	{536}	22,524	(4,505)	[1,081]	{541}
Lubbock	53,078	53,223	53,368	53,513	53,913	(10,783)	[2,588]	{1,294}	54,337	(10,867)	[2,608]	{1,304}	54,792	(10,958)	[2,630]	{1,315}
McLennan	30,940	30,940	30,940	30,940	31,354	(6,271)	[1,505]	{753}	31,789	(6,358)	[1,526]	{763}	32,254	(6,451)	[1,548]	{774}
Montgomery	64,816	65,161	65,505	65,505	66,420	(13,284)	[3,188]	{1,594}	67,360	(13,472)	[3,233]	{1,617}	68,322	(13,664)	[3,279]	{1,640}
Tarrant	284,614	285,466	287,244	288,627	291,329	(58,266)	[13,984]	{6,992}	294,337	(58,867)	[14,128]	{7,064}	297,631	(59,526)	[14,286]	{7,143}
Travis	95,372	95,691	96,009	96,668	97,614	(19,523)	[4,685]	{2,343}	98,627	(19,725)	[4,734]	{2,367}	99,657	(19,931)	[4,784]	{2,392}
Williamson	56,084	56,432	56,780	57,527	58,414	(11,683)	[2,804]	{1,402}	59,358	(11,872)	[2,849]	{1,425}	60,347	(12,069)	[2,897]	{1,448}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.